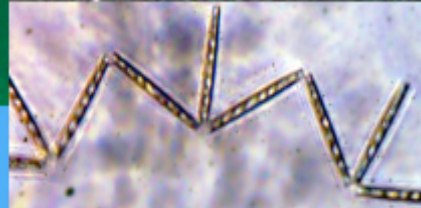
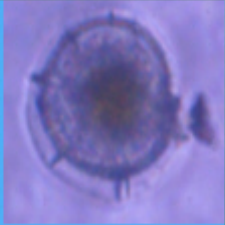
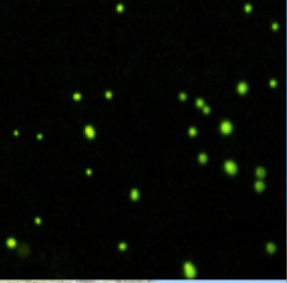


Water quality and material transport processes in La Parguera, Puerto Rico.



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Department of Marine Sciences
UPRM



Overview

Purpose

Study fluctuations of water quality indicators to address changes of water constituents in La Parguera reef systems

Link such fluctuations to modulating processes and to possible system responses.

Students that have participated in this component

Kelly Carbery

Yaritza Rivera

Lumarie Pérez

Rocío García

Carolina Hincapié

Luisa Fernanda Ramírez

Giovany Rojas

Methods

Sampling Approach

Single Time Multi-station Sampling (SiTMusS): consists of collecting discrete water samples for a suite of analyses as well as *in situ* measurements at discrete stations over a short period of time (2-3 hours). These samples represent a quasi-synoptic view of the state of water column constituents and processes.

Serial Semi-continuous Sampling (SeSConS): an *in situ* water quality monitoring system, anchored close to the bottom and moved to a different station every 48hrs. Chlorophyll *a* concentration data (phytoplankton biomass), turbidity, salinity, temperature, and depth (tidal stage) are collected.

Special Efforts (SE): sampling related to the expression of unpredictable atmospheric events on coral reef ecosystem water column constituents or other initiatives.

Table 1. Variables measured during each type of sampling. SE usually include only multiprobe data, suspended solids, and DOM fluorescence.

Type of sampling	Analysis	Type of Analysis	Intrumentation
SiTMuSS	Salinity Turbidity Temperature Chlorophyll a Bacterial counts Unicellular Cyanobacteria Total suspended solid Bacterial production Water Transparency DOM Fluorescence	Conductivity Nephelometry Termistor Acetone Extraction Fluorometric DAPI Epifluorescence Autofluorescence Dry weigth analysis Leucine Incorporation Attenuation of PAR Spectrofluorometric	Multiprobe (Horiba AU22) Multiprobre (Horiba AU22) Multiprobre (Horiba AU22) Spectrofluorometer (Hitachi SF2000) Olympus BX-41 Olympus BX-41 Analytical balance (4 dec places) Liquid Scintillation Counter (Beckman) Cosine Par Collector (Licor) Spectrofluorometer (Hitachi SF2000)
SeConS	In vivo Chlorophyll a Fluorescence Turbidity Temperature Salinity Tidal Stage	In vivo fluorescence Nephelometry Termistor Conductimetric Pressure	SCUFA II (Turner Designs) SCUFA II (Turner Designs) DST-CTD (Star-Oddi) DST-CTD (Star-Oddi) DST-CTD (Star-Oddi)

Location

Stations were selected to account for a large portion of the environmental variability in La Parguera. Consideration was given to land-ocean and longshore gradients (Fig. 1). Between 10 and 14 stations were sampled in this effort.

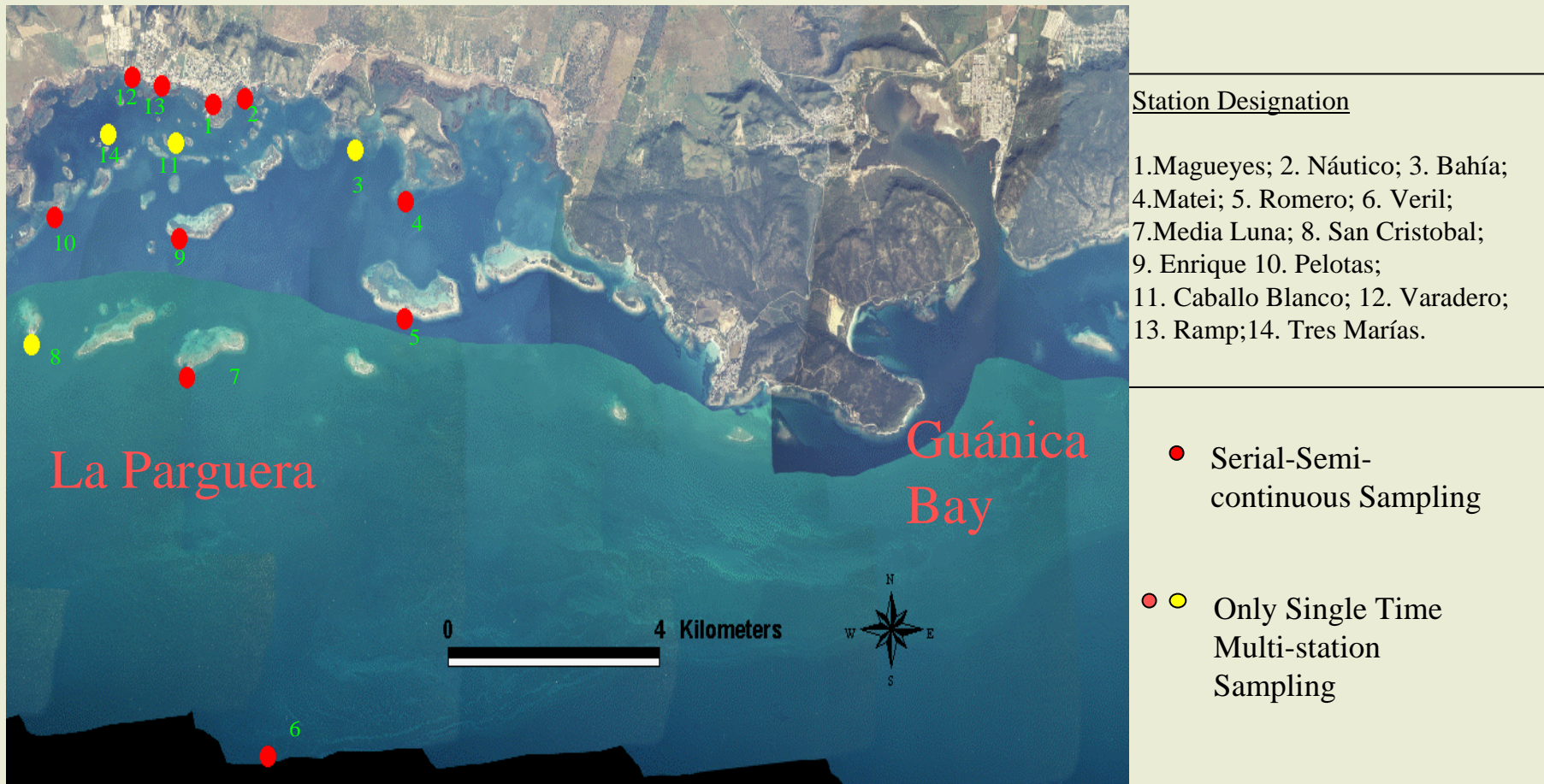
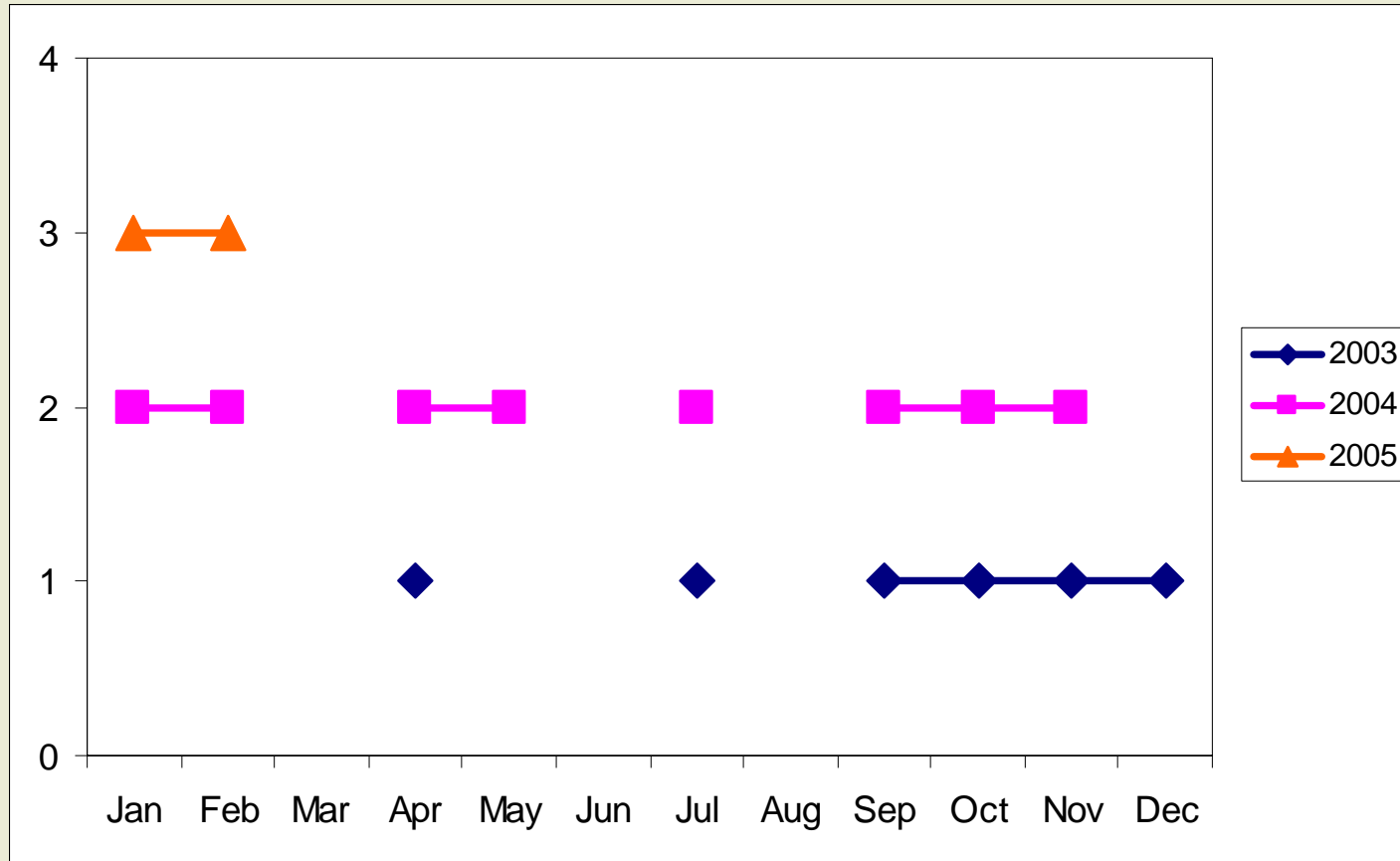


Fig. 1. Stations visited during water quality and material transport work. The predominant sources of materials are the local watershed of the town of La Parguera, mangroves, seagrasses, open ocean, and the nearby estuary of Guánica Bay.

Summary of data collection activities from July 2003-Jan 2005

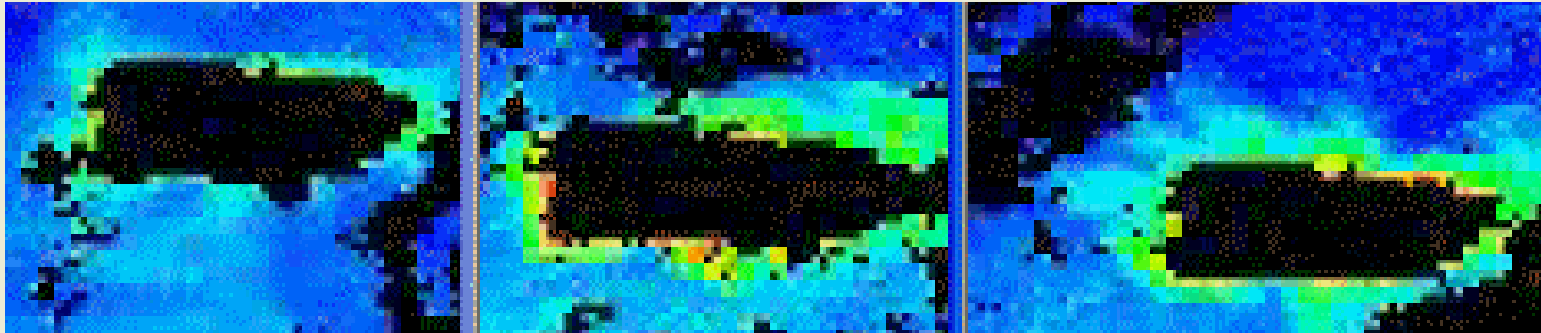


Details of data at <http://biogeo.nos.noaa.gov/cres/updates/Otero%20sept%202004.pps.pdf>

Fluctuations of Water Quality Parameters

Impacts of storms on Water Quality on Reef Systems

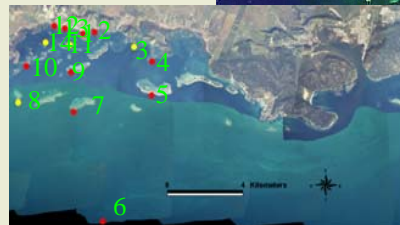
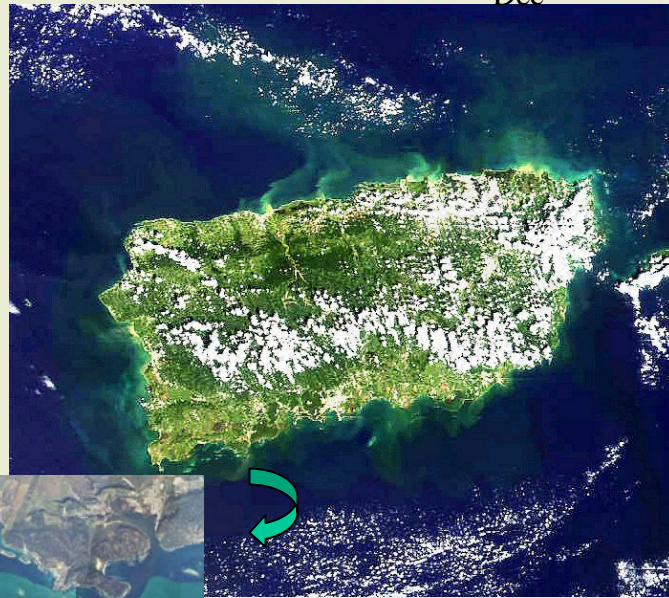
Heavy rainfall (ca. 15 inches) on 13-16 November 2003 was associated with fluctuation of water quality in reef systems.

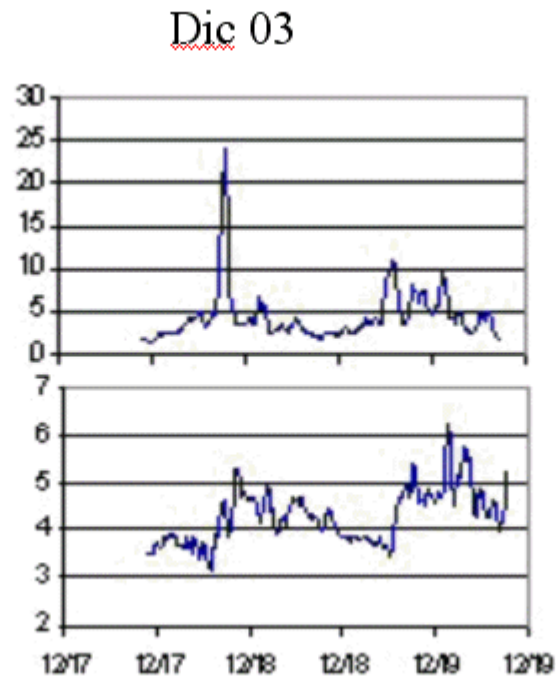
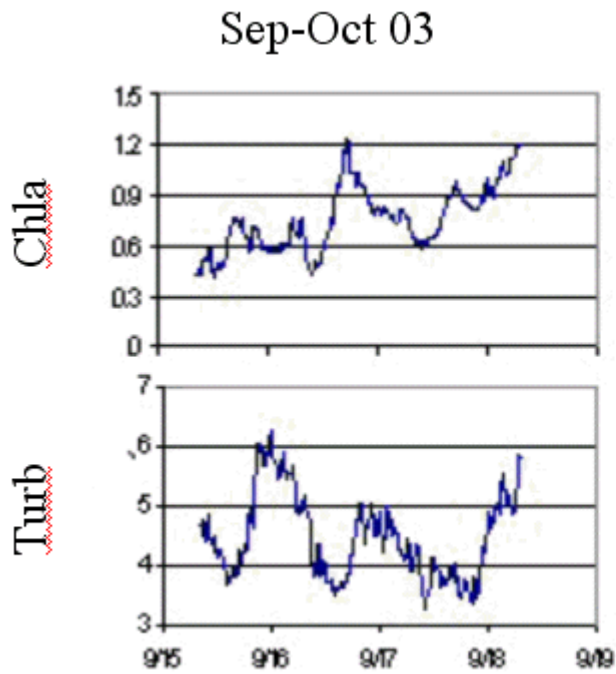


Oct

Nov

Dec





After/Before Ratio

10-20

Varadero

1

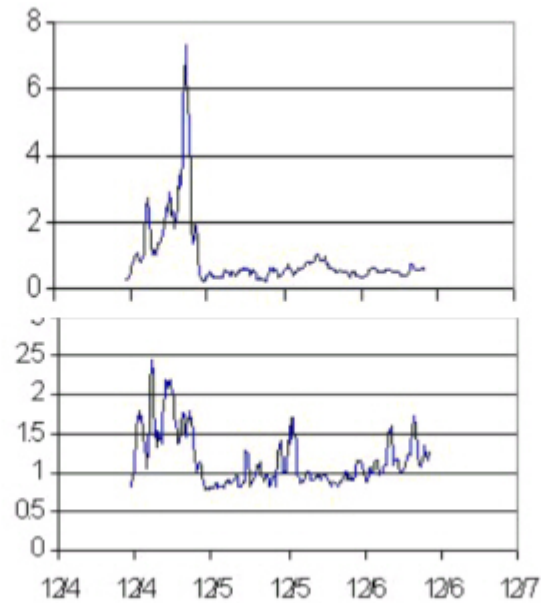
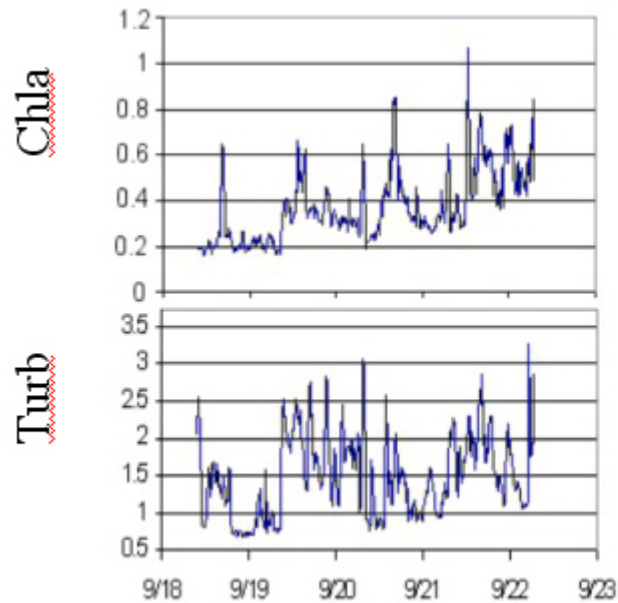


SCUFA II

(Chla in ug/L; Turb= NTU)

Sep-Oct 2003

Dec 2003



After/Before Ratio

2-6

Pelotas

0.5-1

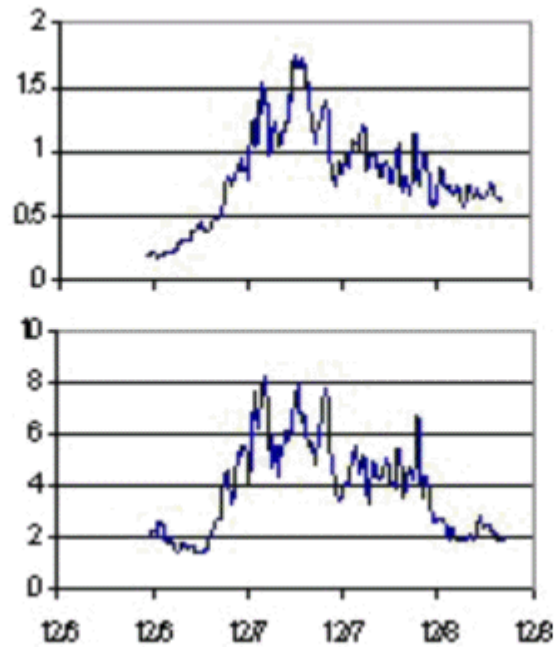
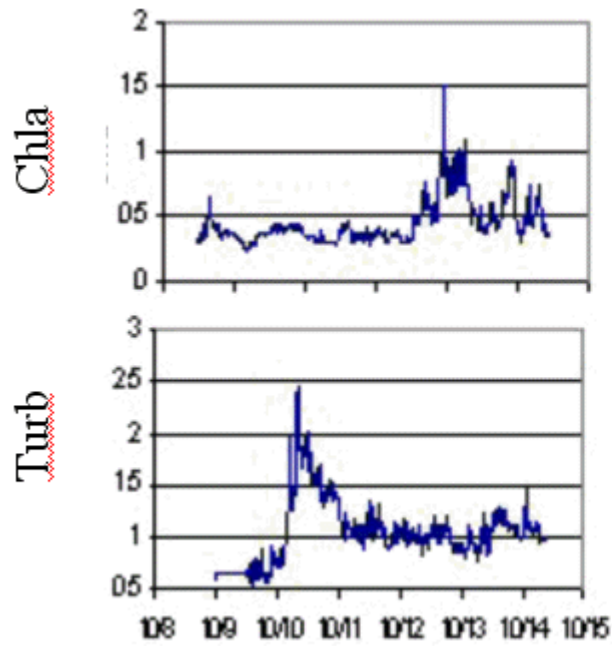


SCUFA II

Chla spikes of 2-6 times previous to storms

Sep-Oct 2003

Dec 2003



After/Before Ratio

1.5

Media Luna

2-4



SCUFA II

Sep-Oct 2003

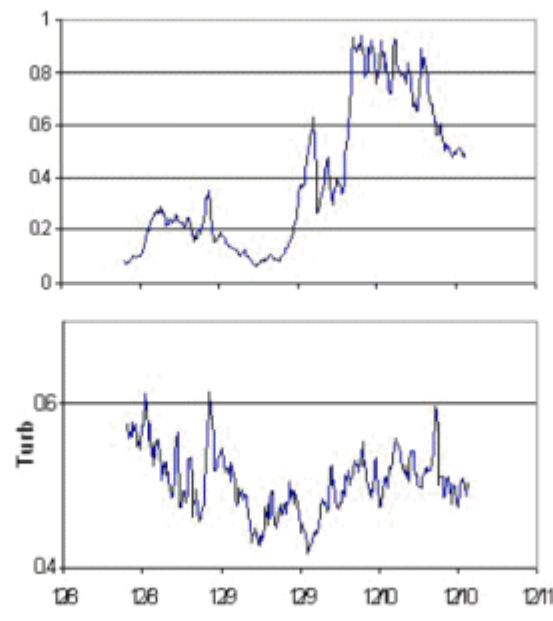
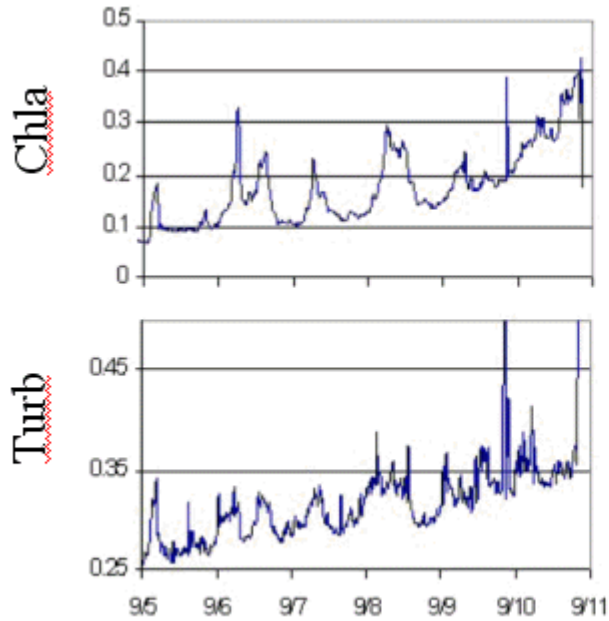
Dec 2003

After/Before Ratio

2

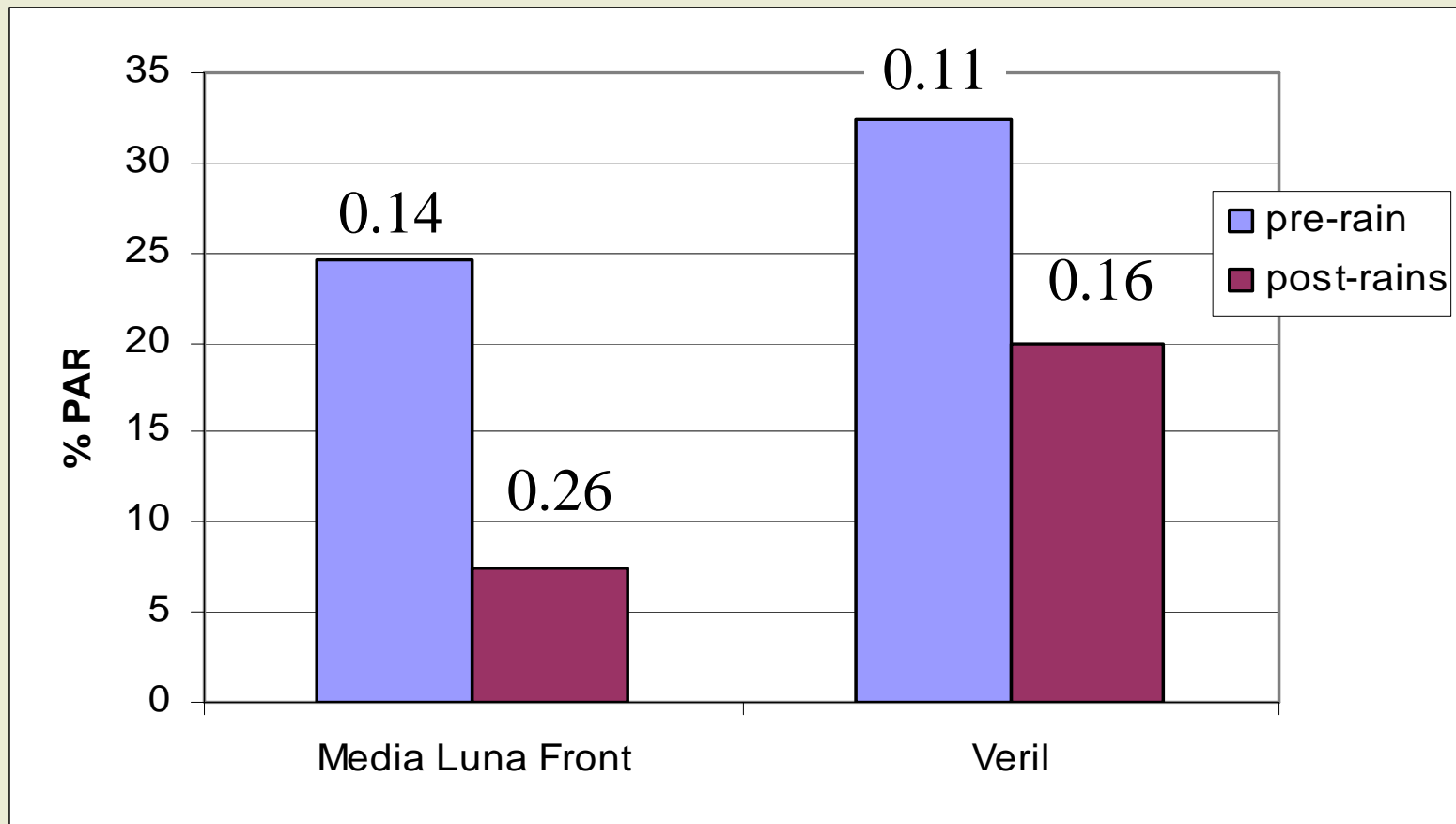
Veril

1.5



SCUFA II

Percent of Photosynthetic active radiation (PAR) previous and after rains at Media Luna Front and El Veril. Number over bars are Kd's

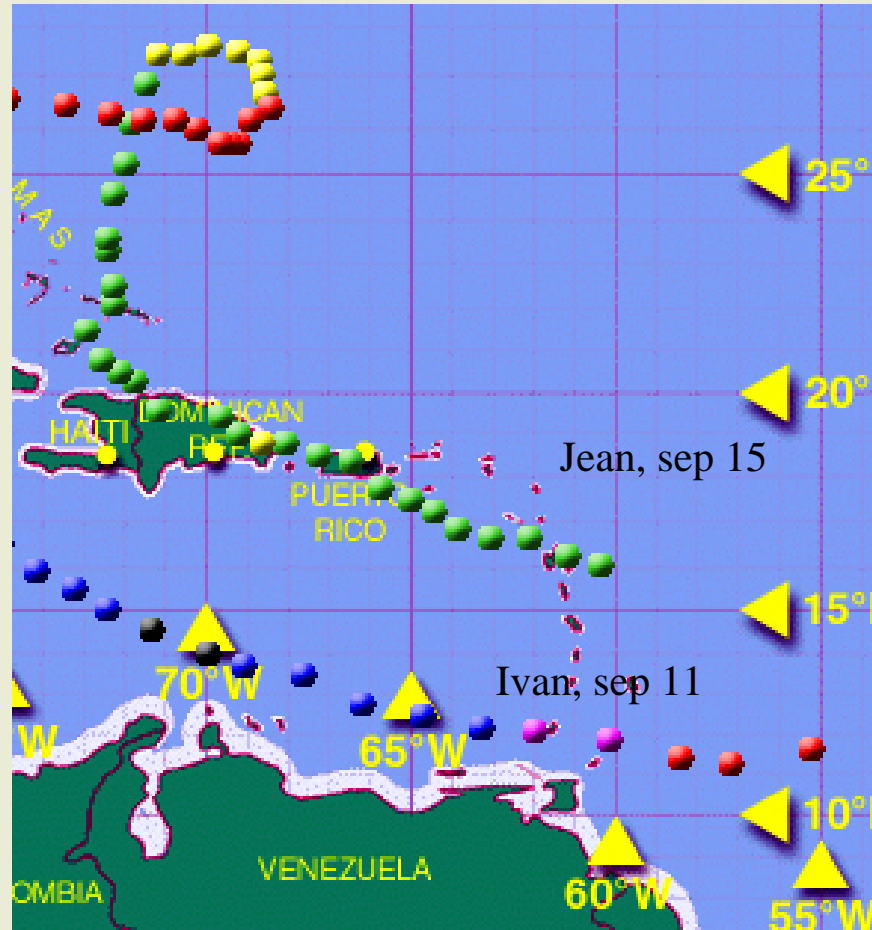


Coral growth of *Acropora cervicornis* in relation with turbidity in Veril and Media Luna (1) front and (2) control reefs in La Parguera.

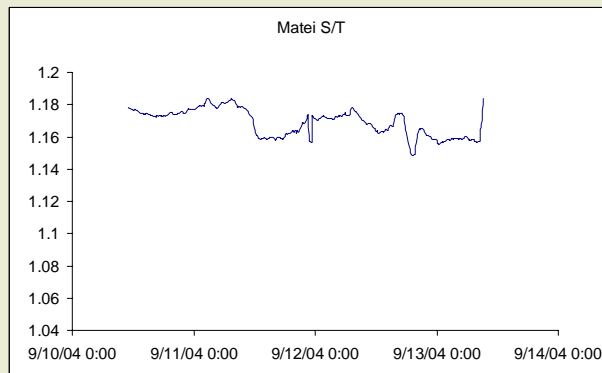
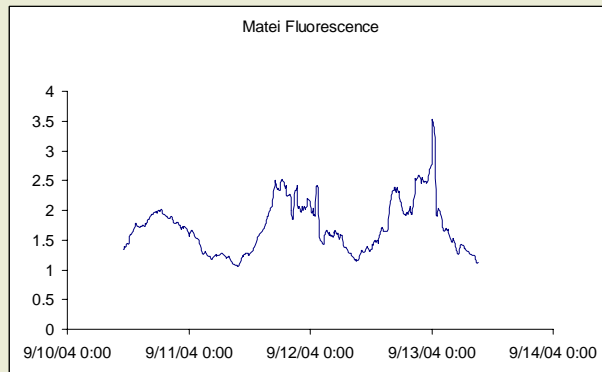
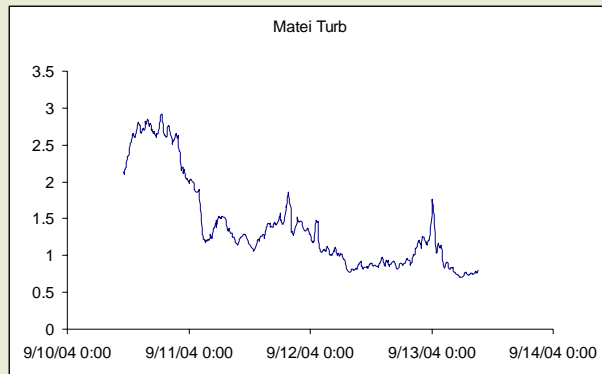
Station	Lineal Growth (cm \pm 1SD)	Survival
Media Luna	0.38 \pm .38	No
Veril	1.13 \pm .72	Yes
Control (Backreef Media Luna)	2.00 \pm .74	Yes



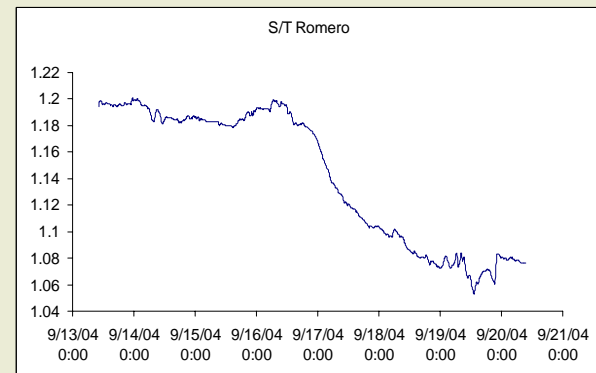
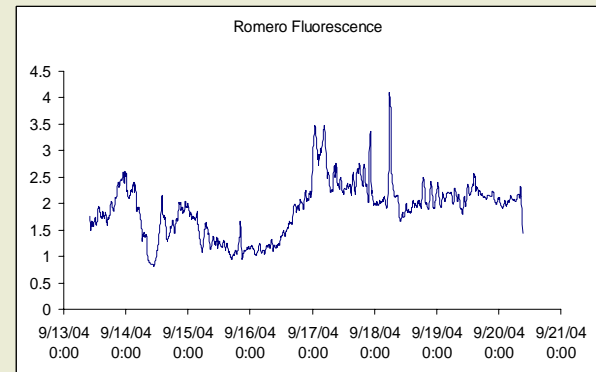
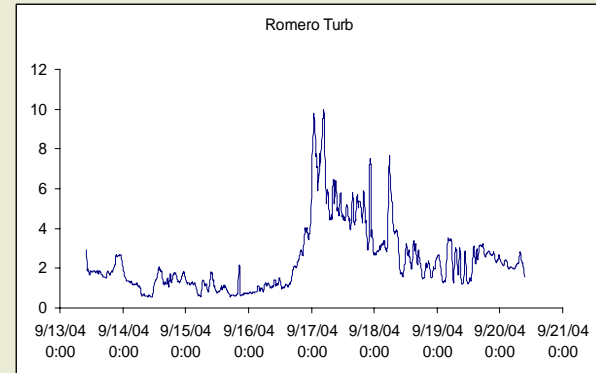
September 2004: Hurricane Trajectories



Effects of Ivan



Effects of Jean



Summary

- Autonomous loggers permitted assessment of water quality during storm related events of variable characteristic of atmospheric patterns (swells vs wind/wet events) allowing estimation of water quality conditions during such events;
- Large inputs of fresh water, suspended sediments and nutrients are associated with these events indicated by changes in salinity, turbidity and phytoplankton biomass;
- Such changes seem enough to modulate the survival of some coral species such as *A. cervicornis*.

Work at Present

- Links of water quality parameters to organic and inorganic nutrients;
- Stable isotope signatures of sediment trap and surficial sediments (fine particles);
- Analysis of microbiological data regarding abundance and production of bacteria and unicellular cyanobacteria;
- Respiration measurements using fluorescence techniques to assess the significance of various coral reef habitats as sources of nutrients at a system level
- Work with an autonomous profiling array which will allow better estimates of material inputs at deep stations vs. bottom anchored instruments.

Related Presentations

- Otero, E., K. Carbery, L. Perez, and Y. Rivera. Chlorophyll *a* and turbidity patterns over coral reefs systems of La Parguera Reserve as derived from continuous water quality sampling. 31st AMLC Scientific Meeting 14-18 July 2003. Port of Spain, Trinidad.
- Carbery, K., E. Otero-Morales and Y. Rivera-Torres. 2004. Spatial and temporal water quality monitoring among coral populations in La Parguera, Puerto Rico. XXIII Simposio Fauna y Flora del Caribe. 30 April, 2004. Humacao, PR.
- Otero, E., K. Carbery and Y. Rivera. 2003. Monitoreo instrumental semi-continuo de calidad de agua de sistemas arrecifales de La Parguera, Puerto Rico. XXIII Simposio Fauna y Flora del Caribe. 30 April, 2004. Humacao, PR.
- Rivera-Torres, Y., K. Carbery and E. Otero. 2004. Determination of Nutrient Limitation of Phytoplankton at La Parguera, Puerto Rico. XXIII Simposio Fauna y Flora del Caribe. 30 April, 2004. Humacao, PR.
- Garcia-Urueña, R.d.P., and E. Otero. 2004. Natural short-term environmental changes, growth and survival of *Acropora cervicornis* as viewed through continued monitoring. 10th ICRS. 28 Jun-2 Jul 2004.

QUESTIONS?

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